# EVB-USB2240-IND
# User's Manual, Rev C

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**Object of Declaration: EVB-USB2240-IND**

EU Declaration of Conformity

This declaration of conformity is issued by the manufacturer.
The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).
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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

16-July-2013
Date

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# Preface

## NOTICE TO CUSTOMERS

**All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.**

**Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.**

**For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.**

## INTRODUCTION

This chapter contains general information that will be useful to know before using the EVB-USB2240-IND. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

## DOCUMENT LAYOUT

This document describes how to use the EVB-USB2240-IND Evaluation Board as a development tool for the USB2240 Ultra Fast USB 2.0 Flash Media Controller. The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-USB2240-IND Evaluation Board.
- **Chapter 2. "Getting Started"** – Includes instructions on how to get started with the EVB-USB2240-IND Evaluation Board.
- **Appendix A. "EVB-USB2240-IND Evaluation Board"** – This appendix shows the EVB-USB2240-IND Evaluation Board.
- **Appendix B. "EVB-USB2240-IND Evaluation Board Schematics"** – This appendix shows the EVB-USB2240-IND Evaluation Board schematics.
- **Appendix C. "Bill of Materials (BOM)"** – This appendix includes the EVB-USB2240-IND Evaluation Board Bill of Materials (BOM).

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

**DOCUMENTATION CONVENTIONS**

| Description | Represents | Examples |
|---|---|---|
| **Arial font:** | | |
| Italic characters | Referenced books | *MPLAB® IDE User's Guide* |
| | Emphasized text | ...is the *only* compiler... |
| Initial caps | A window | the Output window |
| | A dialog | the Settings dialog |
| | A menu selection | select Enable Programmer |
| Quotes | A field name in a window or dialog | "Save project before build" |
| Underlined, italic text with right angle bracket | A menu path | *File>Save* |
| Bold characters | A dialog button | Click **OK** |
| | A tab | Click the **Power** tab |
| N'Rnnnn | A number in verilog format, where N is the total number of digits, R is the radix and n is a digit. | 4'b0010, 2'hF1 |
| Text in angle brackets < > | A key on the keyboard | Press <Enter>, <F1> |
| **Courier New font:** | | |
| Plain Courier New | Sample source code | `#define START` |
| | Filenames | `autoexec.bat` |
| | File paths | `c:\mcc18\h` |
| | Keywords | `_asm, _endasm, static` |
| | Command-line options | `-Opa+, -Opa-` |
| | Bit values | `0, 1` |
| | Constants | `0xFF, 'A'` |
| Italic Courier New | A variable argument | *`file`*`.o`, where *`file`* can be any valid filename |
| Square brackets [ ] | Optional arguments | `mcc18 [options]` *`file`* `[options]` |
| Curly brackets and pipe character: { \| } | Choice of mutually exclusive arguments; an OR selection | `errorlevel {0\|1}` |
| Ellipses... | Replaces repeated text | `var_name [, var_name...]` |
| | Represents code supplied by user | `void main (void) { ... }` |


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## THE MICROCHIP WEB SITE

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART Plus and PIC-kit 2 and 3.

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- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at:
http://www.microchip.com/support

## DOCUMENT REVISION HISTORY

### Revision A (July 2014)

- Initial Release of this Document.

### Revision B (September 2014)

- Update to **Section 1.2 "Features"**


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# Chapter 1. Overview

## 1.1 INTRODUCTION

The EVB-USB2240-IND is an Ultra Fast USB 2.0 Multi-Slot Flash Media Controller with Secure Digital (SD), MultiMediaCardTM (MMC), Memory Stick® (MS), and xD-Picture CardTM (xD) connectors. The EVB-USB2240-IND demonstrates a standalone application for developers of the following applications: Flash Media Card Reader/Writer, printers, desktop and mobile PCs, consumer A/V, and flat panel displays, among others.

## 1.2 FEATURES

The EVB-USB2240-IND provides the following features:

- 36-Pin QFN (RoHS compliant) package.
- Supports these Media Types on Media I/F:
  - Secure Digital (SD2.0, HS-SD, HC-SD)
  - MultiMediaCardTM 4.2
  - xD-Picture CardTM (population deprecated on modern assemblies)
  - Memory Stick® 1.43
  - High Speed Memory StickTM
  - Memory Stick Pro-HGTM
  - Memory Stick Duo Memory Stick ProTM
- Internal FET power switch for all media types; no external power FETs needed.
- Optionally supports external configuration.
  - External I2C EEPROM for configuration options (optional).
- Low cost 4-Layer space saving design.
- Self-powered or bus-powered operation.
- Operates from a single voltage (+5.0 VDC, regulated) external power supply or from VBUS.
- Single onboard +3.3 VDC regulator.
- Optional +3.3 VDC media power LED indicator.
- Activity LED indicator.
- Single crystal clock source.

## 1.3 GENERAL DESCRIPTION

The EVB-USB2240-IND is an evaluation and demonstration platform featuring the USB2240 Ultra Fast USB 2.0 Flash Media Controller on a 4-layer RoHS compliant printed circuit board.

The EVB-USB2240-IND is designed to demonstrate the unique features of this device using a low-cost PCB implementation. It is designed to support internal default configuration settings and an external I2C EEPROM (optional) for customized configured functionality. When an I2C EEPROM device is populated on the evaluation board it provides customizing via USB by using the Microchip-provided USBDM utility, as required.

The EVB-USB2240-IND is compatible with the following:

- Microsoft® Vista
- Windows® XP
- Windows® ME
- Windows® 2k SP4
- Apple® OS X
- Linux® Mass Storage Class Drivers.

Schematics, Layout, and Bill of Materials are included minimizing new product development time.

**FIGURE 1-1: TOP LEVEL SILK SCREEN AND COPPER LAYER**

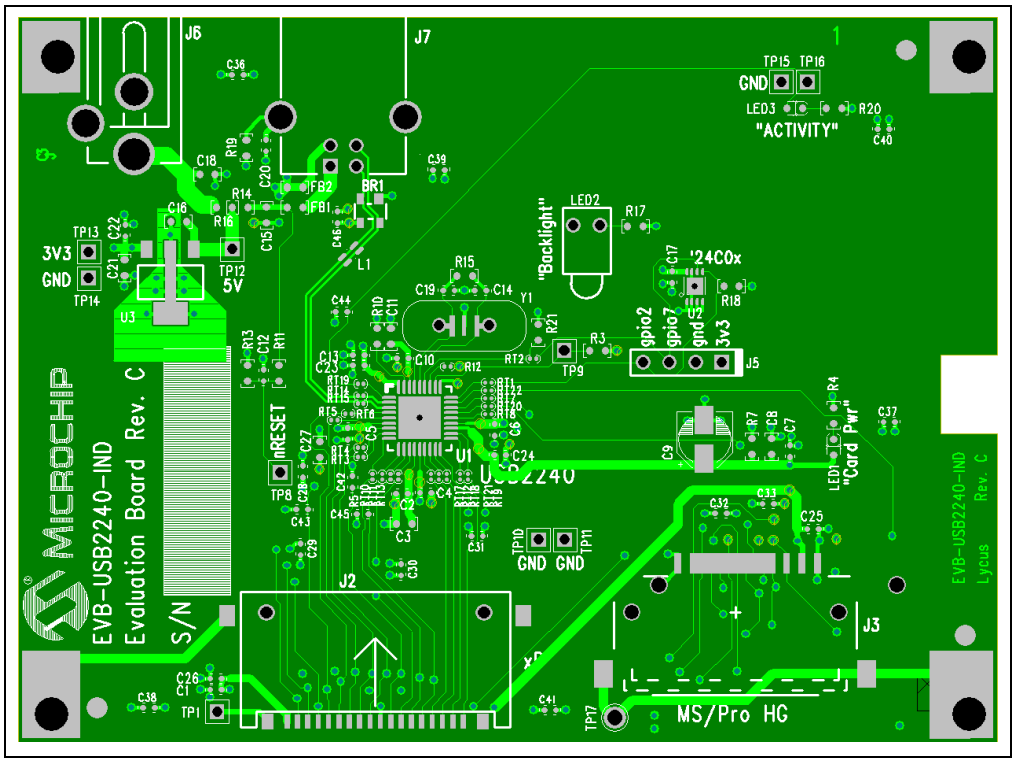



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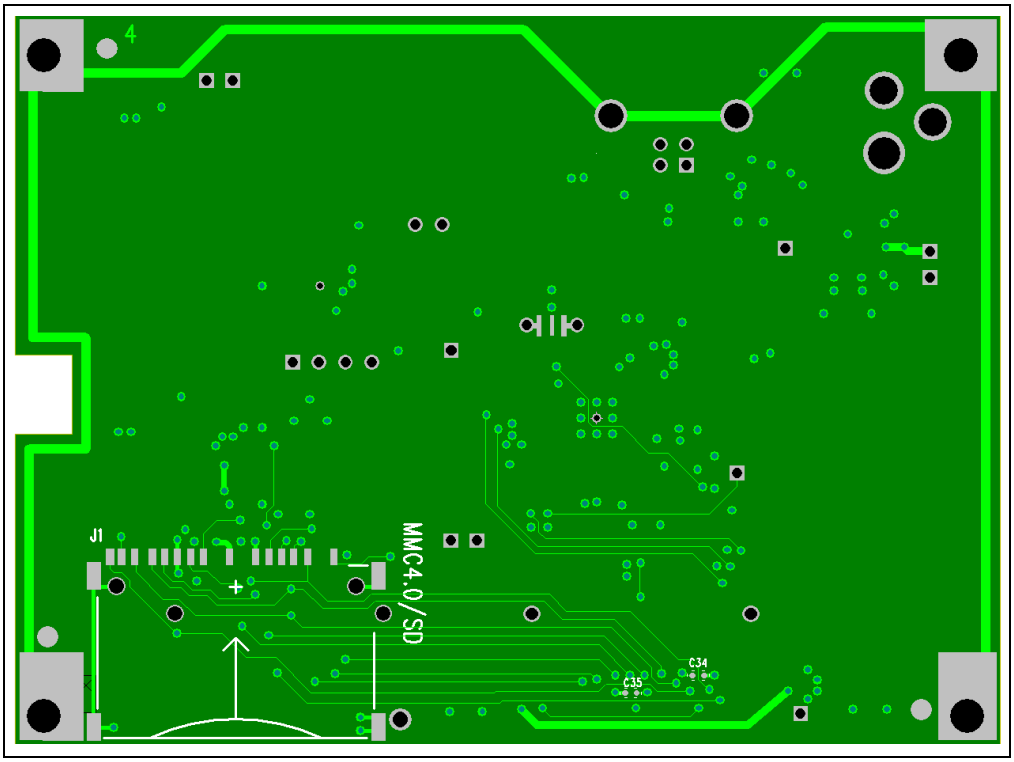
**FIGURE 1-2: BOTTOM LEVEL SOLDIER SIDE AND COPPER LAYER**



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# Chapter 2. Getting Started

## 2.1 HARDWARE CONFIGURATION

The EVB-USB2240-IND has one onboard regulator, which generates +3.3 VDC from an external +5 VDC regulated power supply. The USB2240 generates its own +1.8 VDC for internal use using on-chip +1.8 VDC regulators. The internal 1.8 Volt regulator to the oscillator and PLL is turned off during suspend to minimize suspend current. The USB2240 consumes power from the 3.3 Volt supply.

### 2.1.1 Configuration

**Default:** The EVB-USB2240-IND has been set up to support internal default configuration as determined by the empty state (no valid signature ID) of the EEPROM immediately after reset. When no valid EEPROM image is detected, the Vendor ID, Product ID, Language ID, and Device ID, and a few other choices are set using ROM code defaults.

**EEPROM Option:** The EVB-USB2240-IND can load configuration from an external two-wire, I2C EEPROM U2. The EEPROM must be installed in socket U2. The EEPROM may be pre-programmed before installation, or it can be programmed with the USB host using the provided Microchip USBDM application.

This option allows access to all of the configuration registers and ID strings for the USB2240 device for detailed functional analysis and exercise as desired. The EVB-USB2240-IND is compatible with I2C EEPROMs from several manufacturers. The memory capacity must be at least 512 bytes.

### 2.1.2 Powered State LED

An optional LED, LED1, indicates when +3.3 VDC power is present on the media sockets.

### 2.1.3 Activity LED

LED3 indicates when the USB2240 is active, as defined by firmware.

### 2.1.4 Media Interface

The USB2240 supports a wide array of devices. Media Interface accommodates all of the media types supported through the use of three media socket connectors. Adapters may be needed for some form factors.

- J1 supports SD media up to the specification limit of 4 bits wide. It also supports MMC media up to the specification 4.2 of 8 bits wide.
- J2 supports xD-Picture Card media.
- J3 supports MS, MS Pro, MS Duo, and MS Pro-HG media at up to the specification limit of 8 bits wide.

Since these connectors are all on the same media bus, only one device is allowed to be inserted into any of these media socket connectors at one time for the Media Interface.

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### 2.1.5 Connector Description

The EVB-USB2240-IND has a standard USB style connector of type B for the upstream port. It also has a standard set of media storage style connectors, which supports popular flash media formats from the xD, MS, SD, and MMC families. Power is supplied via a 2.0 mm power jack. Table 2.1 lists all of the connectors. For more details on the pinout of the connectors please schematics in Figure B-1.

**TABLE 2-1: CONNECTOR DESCRIPTION**

| CONNECTOR | TYPE | DESCRIPTION |
|---|---|---|
| J1 | SD/MMC4.0 | SD/MMC I/F |
| J2 | xD | xD I/F |
| J3 | MS/MS Duo/MS Pro-HG | MS I/F |
| J5 | Header | GPIO Test - DNP |
| J6 | Power Jack 2.0 mm | +5 VDC Power Supply - DNP |
| J7 | USB 2.0 Style B | Upstream Port |
| J1 | SD/MMC4.0 | SD/MMC I/F |

### 2.1.6 Power source - Self/Bus Powered

The EVB-USB2240-IND supports both self and bus powered operation. By default the EVB-USB2240-IND is populated for bus powered operation. Refer to the table Table 2.2 below for resistor population options to change the power source.

**TABLE 2-2: POPULATION OPTIONS FOR SELF OR BUS POWERED OPERATION**

| POWER SOURCE | R14 | R16 |
|---|---|---|
| Bus Powered (Default) | Populate | DNP |
| Self Powered | DNP | Populate |

**Note:** DNP = Do not populate.

### 2.1.7 Configuration source - USB Upstream

The Microchip configuration tool named USBDM, see USB2240 Software Release Notes for details (https://www2.smsc.com/mkt/CW_SFT_PUB.nsf/Agreements/OBJ+Card+Reader), can configure the EEPROM when it is populated. USBDM can modify Vendor ID, Product ID, Language ID, Device ID, and configuration settings, see Figure 2.1.

### 2.1.8 Layout Considerations

The EVB-USB2240-IND is designed on four PCB layers: two signal layers and two supply layers. The PCB layer stack is shown in Table 2.3. All signals are routed on top and bottom layers. The internal layers are ground and power. Note that the media I/F signals flow easily to their destination connectors simplifying routing of critical signals.


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**TABLE 2-3: PCB LAYER STACK**

| | | |
|---|---|---|
| Layer 1<br>Component Side | 1.3 - 2.3 oz. Cu finished wt. | 40 mil (+/- 6 mil) |
| | 4.0 - 4.5 mil FR-4 | |
| Layer 2<br>Ground Plane | 1 oz. nominal Cu wt. | |
| Core | ~25 mil FR-4 | |
| Layer 3<br>Power Plane | 1 oz. nominal Cu wt. | |
| | 4.0 - 4.5 mil FR-4 | |
| Layer 4<br>Solder Side | 1.3 - 2.3 oz Cu finished wt. | |

The component side top layer is shown in Figure 1-1 with silk screen information to identify component locations. Solder side and bottom layer is shown in Figure 1-2.

**NOTES:**


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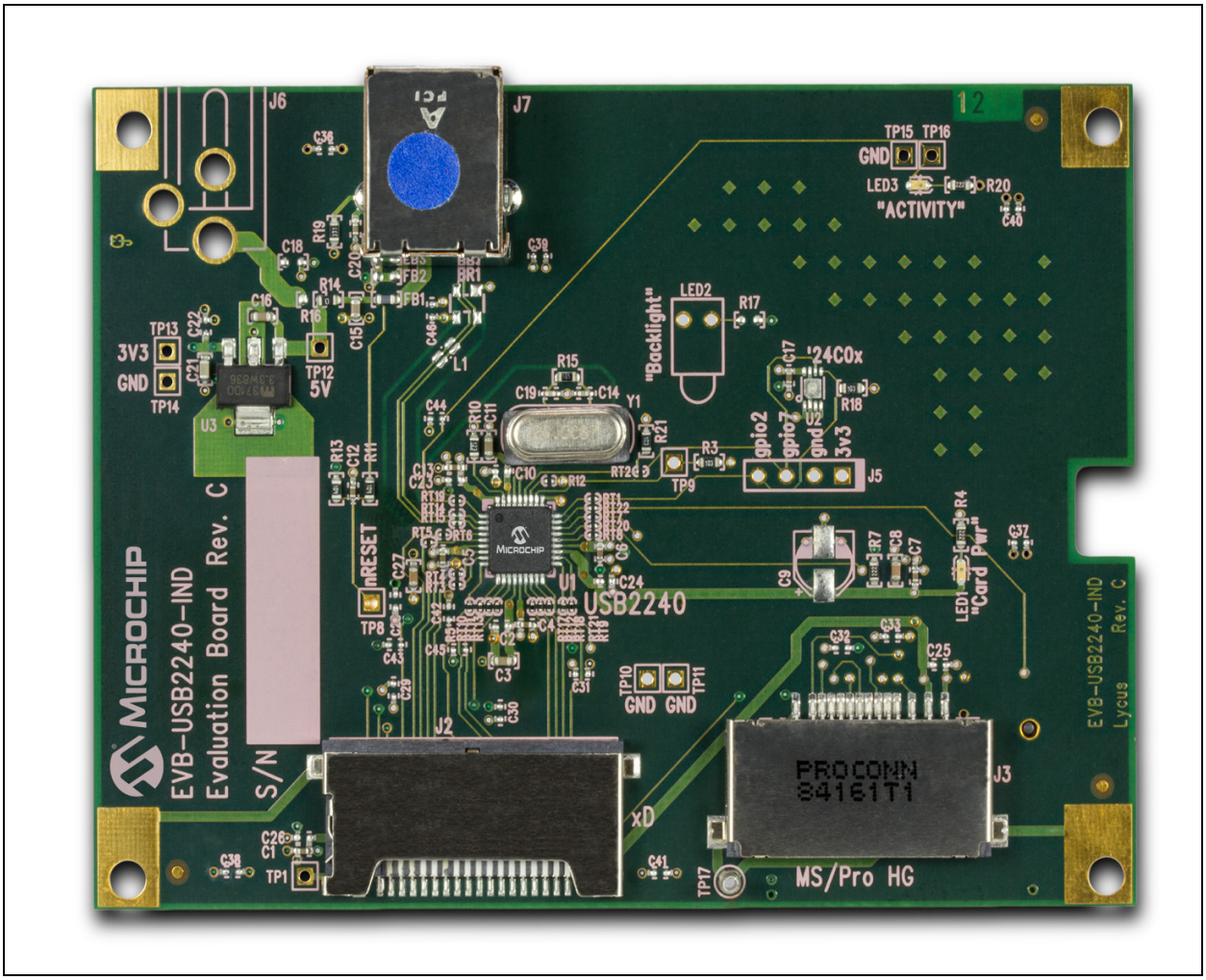
# Appendix A. EVB-USB2240-IND Evaluation Board

## A.1 INTRODUCTION

This appendix shows the EVB-USB2240-IND Evaluation Board.

**FIGURE A-1: EVB-USB2240-IND EVALUATION BOARD**



**NOTES:**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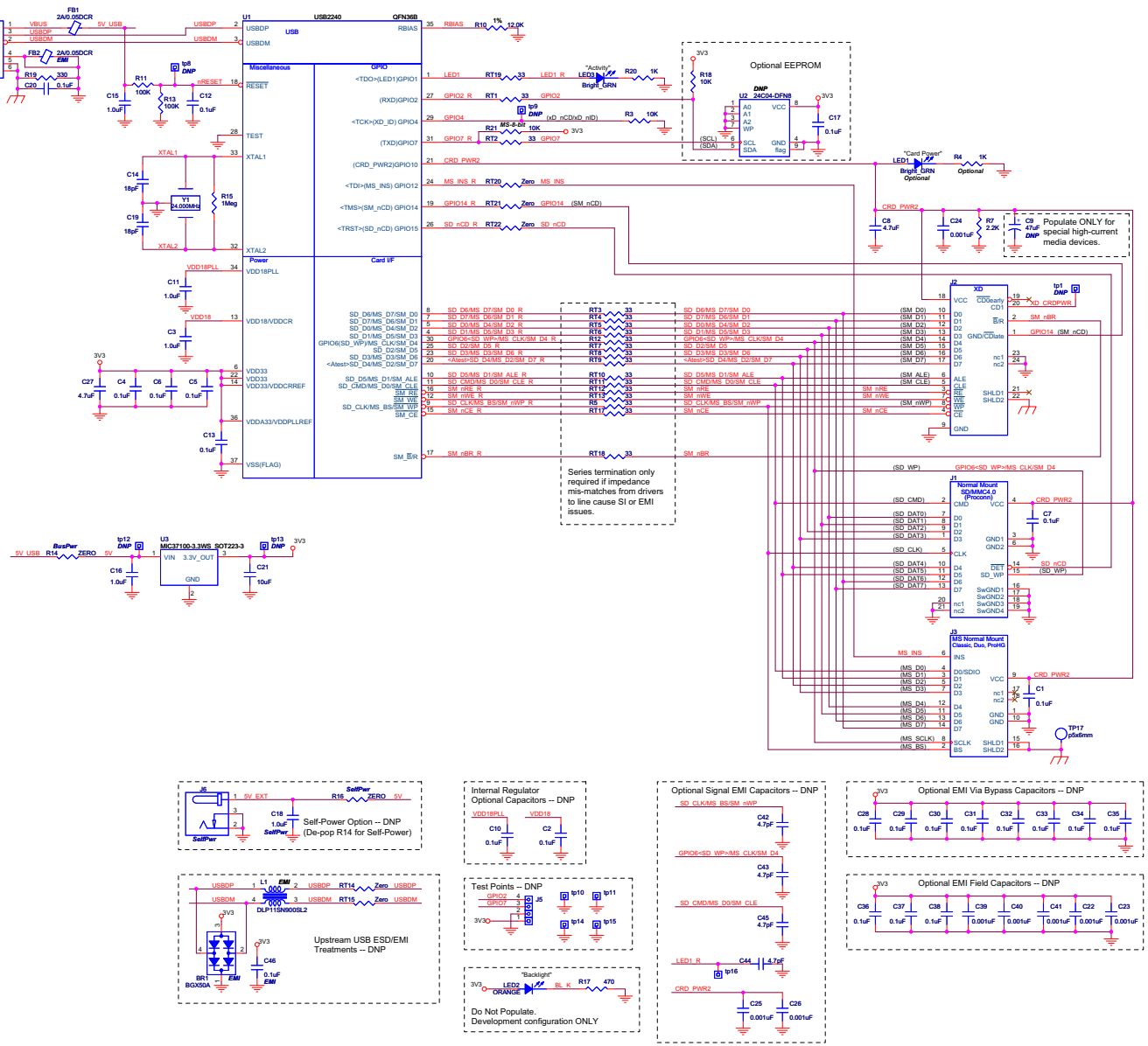
# Appendix B. EVB-USB2240-IND Evaluation Board Schematics

## B.1 INTRODUCTION

This appendix shows the EVB-USB2240-IND Evaluation Board Schematics.

## FIGURE B-1: EVB-USB2240-IND EVALUATION BOARD SCHEMATIC 1


USB2240
QFN36B
Optional EEPROM
Optional Signal EMI Capacitors -- DNP
Optional EMI Via Bypass Capacitors -- DNP
Optional EMI Field Capacitors -- DNP
Internal Regulator Optional Capacitors -- DNP
Test Points -- DNP
Self-Power Option -- DNP (De-pop R14 for Self-Power)
Upstream USB ESD/EMI Treatments -- DNP
Series termination only required if impedance mis-matches from drivers to line cause SI or EMI issues.
Populate ONLY for special high-current media devices.
Do Not Populate. Development configuration ONLY



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# Appendix C. Bill of Materials (BOM)

## C.1 INTRODUCTION

This appendix includes the EVB-USB2240-IND Evaluation Board Bill of Materials (BOM).

**TABLE C-1: EVB-USB2240-IND EVALUATION BOARD BILL OF MATERIALS**

| Item | Qty | Qty Populated | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number | Notes |
|---|---|---|---|---|---|---|---|
| 1 | 9 | 9 | C1,C4,C5,C6,C7,C12,C13,C17, C20 | Capacitor, 0.1uF, 6.3V, 10%, X5R, 0402 | Murata | GRM155R71A104KA01D | |
| 2 | 2 | 2 | C14,C19 | Capacitor, 18pF, 50V, 5%, NPO, 0402 | Murata | GRM1555C1H180JZ01D | Critical Device |
| 3 | 1 | 1 | C21 | Capacitor, 10uF, 6.3VDC, 20%, X5R, 0603 | Murata | GRM188R60J106ME47D | |
| 4 | 4 | 4 | C3,C11,C15,C16 | Capacitor, 1.0uF, 16VDC, 10%, X5R, 0603 | Murata | GRM188R61C105KA93D | |
| 5 | 2 | 2 | C8,C27 | Capacitor, 4.7uF, 6.3VDC, 20%, X5R, 0603 | Murata | GRM188R60J475KE19D | |
| 6 | 1 | 1 | FB1 | Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603 | Murata | BLM18EG221SN1D | |
| 7 | 1 | 1 | J1 | Connector, SD/MMC4.0, Normal Mount, SMT | Proconn | SDC013-A0-5002 | |
| 8 | 1 | 1 | J2 | Connector Housing Assembly, XD, SMT | Proconn | XDC020-A0-0000 | |
| 9 | 1 | 1 | J3 | Connector, Mem. Stick, Classic-Duo-Pro-HG, Top Mount, SMT | Proconn | MSCN14-X0-2200 | |
| 10 | 1 | 1 | J7 | Receptacle, USB, Style B, Right Angle, Through-hole | FCI | 61729-x0xxBLF | |
| 11 | 1 | 1 | LED1 | LED, Bright Green, 0603 | Rohm | SML-412MWT86 | |
| 12 | 1 | 1 | LED3 | LED, Bright Green, 0603 | Rohm | SML-412MWT86 | |
| 13 | 1 | 1 | R10 | Resistor, 12.0K, 1%, 1/16W, 0603 | Panasonic | ERJ-3EKF1202V | Critical Device |
| 14 | 2 | 2 | R11,R13 | Resistor, 100K, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ104V | |
| 15 | 1 | 1 | R14 | Resistor, ZERO, 0.1W, 0603 | Panasonic | ERJ-3GEY0R00V | |
| 16 | 1 | 1 | R15 | Resistor, 1Meg, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ105V | |
| 17 | 1 | 1 | R19 | Resistor, 330, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ331V | |
| 18 | 3 | 3 | R3,R18,R21 | Resistor, 10K, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ103V | |
| 19 | 1 | 1 | R4 | Resistor, 2.2K, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ222V | |
| 20 | 2 | 2 | R7,R20 | Resistor, 2.2K, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ222V | |
| 21 | 18 | 18 | RT1,RT2,RT3,RT4,RT5,R5,RT6, RT7,RT8,RT9,RT10,RT11,RT12, R12,RT13,RT17,RT18, RT19 | Resistor, 33ohm, 5%, 1/20W, 0201 | Rohm | MCR006YZPJ330 | |
| 22 | 3 | 3 | RT20,RT21,RT22 | Resistor, Zero, 5%, 1/20W, 0201 | Rohm | MCR006YZPJ000 | |
| 23 | 1 | 1 | TP17 | Pin, Ferrule, Uninsulated, for 0.5mm wire, 6mm long | Phoenix Contact | 3200218 | |
| 25 | 1 | 1 | U1 | IC, USB2240, USB 2.0 Bus Powered Flash Media Controller, QFN-36B | SMSC | USB2240-AEZG | |
| 25 | 1 | 1 | U3 | IC, MIC37100-3.3WS, LDO Regulator, 3.3V, 1A, SOT223-3 | Micrel | MIC37100-3.3WS | |
| 26 | 1 | 1 | Y1 | Crystal, 24.000MHz, 50ppm, 18pF, HC-49SMT | Citizen America | HCM49-24.000MABJ-UT | |



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**TABLE C-1: EVB-USB2240-IND EVALUATION BOARD BILL OF MATERIALS (CONTINUED)**

| Item | Qty | Qty Populated | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number | Notes |
|---|---|---|---|---|---|---|---|
| 27 | 1 | 0 | BR1 | Diode, Bridge, Switching, 50V, 140mA, KCAC, SOT-143 | Infineon Tech | BGX50A | Do Not Populate |
| 28 | 1 | 0 | C18 | Capacitor, 1.0uF, 16VDC, 10%, X5R, 0603 | Murata | GRM188R61C105KA93D | Do Not Populate |
| 29 | 2 | 0 | C2,C10 | Capacitor, 0.1uF, 6.3V, 10%, X5R, 0402 | Murata | GRM155R71A104KA01D | Do Not Populate |
| 30 | 8 | 0 | C22,C23,C24,C25,C26,C39, C40,C41 | Capacitor, 1000pF, 50V, 10%, X7R, 0402 | Murata | GRM155R71H102KA01D | Do Not Populate |
| 31 | 12 | 0 | C28,C29,C30,C31,C32,C33, C34,C35,C36,C37,C38,C46 | Capacitor, 0.1uF, 6.3V, 10%, X5R, 0402 | Murata | GRM155R71A104KA01D | Do Not Populate |
| 32 | 4 | 0 | C42,C43,C44,C45 | Capacitor, 4.7pF, 50V, +/-0.25pF, NPO, 0402 | Murata | GRM1555C1H4R7CZ01D | Do Not Populate |
| 33 | 1 | 0 | C9 | Capacitor, 47uF, 16VDC, 20%, Aluminum, SMT, 5mm x 6mm | Panasonic | EEV-FK1C470UR | Do Not Populate |
| 34 | 1 | 0 | FB2 | Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603 | Murata | BLM18EG221SN1D | Do Not Populate |
| 35 | 1 | 0 | J5 | Header, 1 x 4, 0.1 Inch, Vertical | AMP | 9-146285-0 | Do Not Populate |
| 36 | 1 | 0 | J6 | Connector, Power Jack, 2.0mm, 12V, 4A, Right Angle | Cui Stack | PJ-002AH | Do Not Populate |
| 37 | 1 | 0 | L1 | Inductor, Common Mode Choke, DLP11SN900SL2, 0504 | Murata | DLP11SN900SL2 | Do Not Populate |
| 38 | 1 | 0 | LED2 | LED, Orange, 5mm, TH, Right Angle | Dialight | 550-2505 | Do Not Populate |
| 39 | 1 | 0 | R16 | Resistor, ZERO, 0.1W, 0603 | Panasonic | ERJ-3GEY0R00V | Do Not Populate |
| 40 | 1 | 0 | R17 | Resistor, 470, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ471V | Do Not Populate |
| 41 | 2 | 0 | RT14,RT15 | Resistor, Zero, 5%, 1/20W, 0201 | Rohm | MCR006YZPJ000 | Do Not Populate |
| 42 | 10 | 0 | tp1,tp8,tp9,tp10,tp11,tp12, tp13,tp14,tp15,tp16 | Header, 1 x 1, 0.1 Inch, Vertical | AMP | 9-146285-0 | Do Not Populate |
| 43 | 1 | 0 | U2 | IC, 24C04, 2 Wire Serial EPROM, 4Kb, 2.5V, DFN-8 | Microchip Technology | 24LC04BT-I/MC | Do Not Populate |

**NOTES:**

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